

WHAT IS CLAIMED IS:

1. An optical AND gate including:

a nonlinear optical medium for inputting signal light having a first wavelength and probe light having a second wavelength different from the first wavelength and producing cross phase modulation of the probe light with the signal light to thereby output spectrally broadened light; and

an optical filter for extracting light including a modulated component of the signal light and having a band narrower than the band of the spectrally broadened light, from the spectrally broadened light.

2. A waveform shaping device including:

a second nonlinear optical medium for inputting output light from an optical AND gate according to claim 1 and producing self phase modulation of the output light from the optical AND gate to thereby output second spectrally broadened light; and

a second optical filter for extracting light including a signal component of the output light from the optical AND gate and having a band narrower than the band of the second spectrally broadened light, from the second spectrally broadened light.

3. A waveform shaping device including:

a second nonlinear optical medium for inputting output light from an optical AND gate according to claim 1 and second probe light having a wavelength different from the wavelength of the output light from the optical AND gate and producing cross phase modulation of the second probe light with the output light from the optical AND gate to thereby output second spectrally broadened light; and

a second optical filter for extracting light including a signal component of the output light from the optical AND gate and having a band narrower than the band of the second spectrally broadened light.

4. A waveform shaping device including:

an optical AND gate;

a nonlinear optical medium for inputting output light from the optical AND gate and probe light having a wavelength different from the wavelength of the output light from the optical AND gate and producing cross phase modulation of the probe light with the output light from the optical AND gate to thereby output spectrally broadened light; and

an optical filter for extracting light including a signal component of the output light from the optical AND gate and having a band narrower than the band of the

spectrally broadened light, from the spectrally broadened light.

5. An optical AND gate or a waveform shaping device according to claim 1, 2, 3, or 4, wherein the signal light and the probe light to be input into the optical AND gate are light obtained by broadening the pulse width of signal light from a transmission line and an optical clock extracted from the signal light from the transmission line, respectively.

6. An optical AND gate or a waveform shaping device according to claim 1, 2, 3, or 4, wherein the nonlinear optical medium is a single-mode optical fiber.

7. A waveform shaping method including the steps of:

inputting signal light having a first wavelength and probe light having a second wavelength different from the first wavelength into a nonlinear optical medium and producing cross phase modulation of the probe light with the signal light in the nonlinear optical medium to thereby output spectrally broadened light; and

extracting light including a modulated component of the signal light and having a band narrower than the band of the spectrally broadened light, from the spectrally broadened light.

8. A waveform shaping method including the steps of:

inputting output light obtained by a method according to claim 7 into a second nonlinear optical medium and producing self phase modulation of the output light to thereby output second spectrally broadened light; and

extracting light including a signal component of the output light and having a band narrower than the band of the second spectrally broadened light, from the second spectrally broadened light.

9. A waveform shaping method including the steps of:

inputting output light obtained by a method according to claim 7 and second probe light having a wavelength different from the wavelength of the output light into a second nonlinear optical medium and producing cross phase modulation of the second probe light with the output light to thereby output second spectrally broadened light; and

extracting light including a signal component of the output light and having a band narrower than the band of the second spectrally broadened light, from the second spectrally broadened light.

10. A waveform shaping device including:

first means for splitting input signal light into first signal light and second signal light;

second means for waveform-shaping the first signal light to output waveform-shaped light;

third means for extracting an optical clock from the second signal light;

fourth means for inputting the waveform-shaped light and the optical clock, broadening the spectrum of the optical clock under AND conditions to obtain first spectrally broadened light, and extracting a predetermined band from the first spectrally broadened light; and

fifth means for inputting output light from the fourth means, broadening the spectrum of the output light to obtain second spectrally broadened light, and extracting a predetermined band from the second spectrally broadened light.

11. An optical communication system including a transmitter, a receiver, an optical transmission line for connecting the transmitter and the receiver, and a device according to claim 10 inserted in the optical transmission line.